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Workshop H: Managing Electric Costs in a Highly Volatile Environment

Introduction to Toshi

- Toshi is a medium-scale cryptocurrency mining company, currently focused on Bitcoin.
- We're repurposing a 20-acre industrial site in north-central Ohio with easy access to grid-based industrial power.
- First, we'll talk about how Mining establishes and maintains the security of the Bitcoin network.
- Then, we'll look at how Toshi manages its energy consumption to minimize costs.

Introduction to Bitcoin

- To understand mining, first we need a basic understanding of what the Bitcoin network is, and how it functions.
- The Bitcoin Network is a decentralized, permissionless, accounting ledger, running on thousands of computers all around the world.
- That's it! It's a record of accounts (Addresses), and transactions that determine how much Bitcoin has been added to or subtracted from each account.
- But how do you secure a decentralized, permissionless ledger system? Therein lies the complication.

Bitcoin Network Security

- A full description of Bitcoin security is well beyond the scope of a single presentation, but there are a couple of core elements important to understanding mining's contribution.
- We can think of these elements as answers to some basic questions on how we want to conduct our network:
- How do we build consensus on our network as to what the real ledger is in the first place?
- How can we confirm that our record of transactions hasn't been tampered with?
- How do we add to our ledger and maintain its neutrality over time?
- Finally, how do we ensure each transaction is authorized?

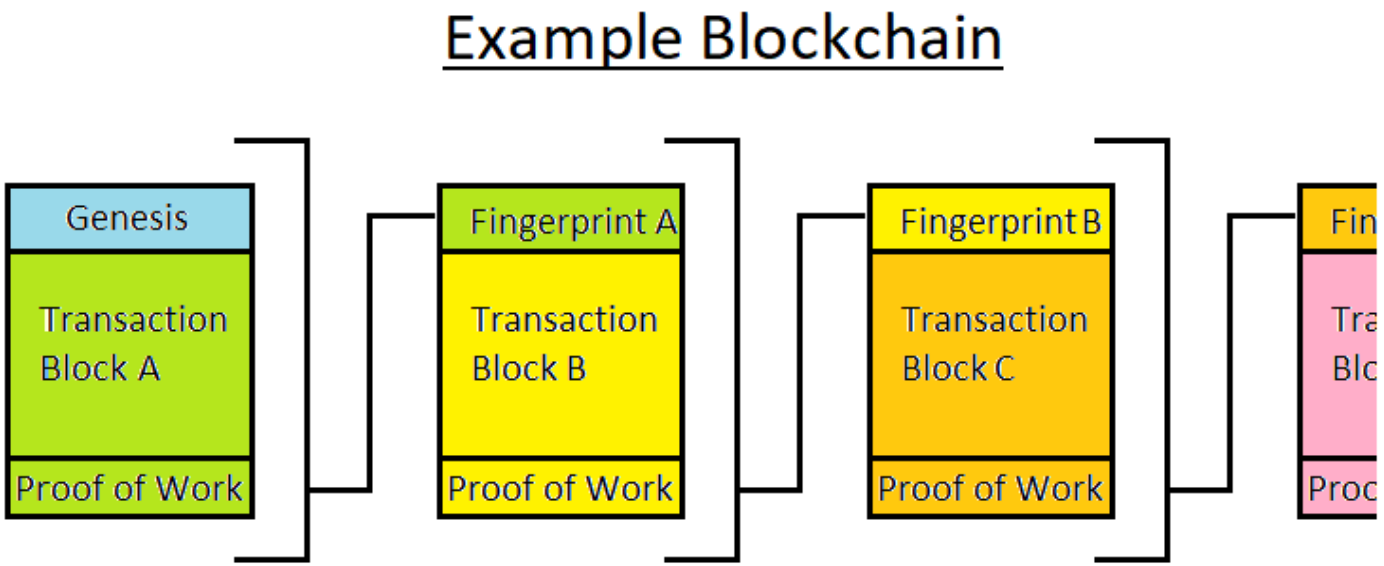
Building Consensus

- Since we're in a distributed network, an efficient framework for determining the "real" ledger is very important.
- Bitcoin adopts a proof of work, rules-based blockchain approach.
- Simply put, if there is disagreement, the most work intensive (longest) blockchain that follows the rules of the Bitcoin protocol wins.
- But what are the rules the ledger must follow, and what is a blockchain?

Blockchain Basics

- A blockchain is a method of breaking up the ledger of transactions into discrete chunks or “blocks” in order to use cryptography to gain our tamper-resistance.
- The Bitcoin ledger must be made up of a chain of valid sequential blocks to be recognized, and each block (except for the first) must have three elements:
- A correct, unique cryptographic fingerprint of the previous block.
- A set of valid transactions.
- A solution to a math puzzle based on the first two elements.
- Let’s focus on those first and last elements.

Blockchain Example Diagram



Hashing

- Our fingerprint of previous blocks is achieved through a technique called hashing.
- In hashing we take an input, pass it through a randomization algorithm, and obtain a unique identifier called, predictably, a hash. This will usually be a long string of characters.
- Hashing is computationally very easy to do, and thus verify. But it's very hard to take a desired hash and work backwards to what the input was.
- Importantly, even a small change to the input will completely, unpredictably change the hash.
- Let's look at what this fingerprint gets us.

An Example Attack!

- Conceptually, the simplest “attack” on the Bitcoin network might be an attempt to modify the existing blockchain and publish it as correct.
- By changing previous blocks, hashes in the chain will no longer match what you’d expect.
- But hashing is easy! Just recalculate new hashes for each block forward from the change and broadcast your new, valid blockchain.
- Remember, though, there’s a third element of a valid block, and this underpins the entire security of the Bitcoin protocol.

Proof of Work

- A valid block must include proof of work, the solution to the math problem we referenced earlier.
- This solution, in slightly simplified terms, is a random number we include at the end of the block that causes our block hash to match certain criteria.
- As we've said repeatedly, hashing is easy, but because hashes are random, finding a specific hash can be very difficult. As difficult as the hash is specific.
- The only way to find a number that results in a correct hash is to guess, and guess… and keep guessing! This can be as computationally intensive as you like, just keep making the hashes longer and more specific.
- This process of guessing is, you guessed it, Mining!

An Attack Fails

- Now revisit our example attack. What happens when we add proof of work to the block?
- The attacker attempts to revise an existing transaction, but now runs into a problem when they try to rehash their blockchain.
- The proof of work solutions in each block no longer combine with the altered transactions and previous hashes to produce the new specific hashes needed moving forward in the chain.
- This issue rolls forward into each block, forcing recalculation of proof of work for each block forward from the point of alteration to create a new, valid blockchain.

How Much Security?

- How much of a problem would this be if you tried to modify the current Bitcoin blockchain?
- The network targets ten minutes worth of calculation for the proof of work for each block, and miners currently guess the number needed to solve a block about 250 quintillion times a second.
- Assuming you could source the most advanced hardware currently available, the current electricity cost alone of recalculating the Bitcoin blockchain for the last year would be somewhere from $1-5 Billion.
- But remember the longest chain wins on the network. You'd have to recalculate the chain MUCH faster than the rest of the network is currently working to catch up to it. The costs of getting enough computing power to perform a modification in a useful amount of time would be… prohibitive.

Extending the Ledger

- We've established that the blockchain is highly tamper resistant, and this gets worse the farther you attempt to backdate a change, but what about the present?
- How do we extend the ledger in a way that is reliable, fair, and secure?
- This is also a role that miners perform. Finding the solution to the current block's proof of work requirement gives you permission to propose a new block of transactions to the network.
- To keep our ledger accurate and secure, miner incentives must be aligned with the network's interests.

Why Mine?

- Miners need compensation to keep their specialized proof of work computers running 24/7 and new blocks coming in every ten minutes.
- This compensation comes in the form of the Block Reward, new Bitcoin that the proposer of a new block can issue themselves. Right now this is 6.25 BTC per block.
- When you send a transaction to the Bitcoin network, it also includes a fee that is issued to whomever publishes that transaction as part of a block they propose.
- This creates competition among miners for the block and fee rewards. Solving more proof of work puzzles faster lets you publish more blocks and claim more rewards.

An Example Attack Pt. 2

- There are several ways miners (anyone with significant processing power, really) can attack the network by adding “valid” but somehow malicious blocks onto the network.
- Publishing a block that has incorrect transactions is a pure waste of time. We’ll cover why in a bit.
- We won’t worry too much about getting into the weeds here, many of these attacks are very technical and relate to the protocol’s distributed network and how it communicates with itself.
- Let’s just say it can be done, and this is much less difficult than altering the distant block history, since you only have to recalculate very recent blocks or correct blocks moving forward.
- So why doesn’t this happen in practice?

An Attack Fails Pt. 2

- First, this is still pretty expensive. The total block reward in a year is in the billions of dollars, which leads to ample competition from legitimate miners for the solutions to new blocks.
- The nature of most of these attacks require the attacker to keep producing new blocks faster than the rest of the network. You'd need to establish and then maintain more than 50% of the network's processing power, non-trivial.
- A durable "51%" attack would require, at least, tens of billions of dollars of investment in computers and energy infrastructure, and billions of dollars in maintenance and electricity costs per year. It would also be obvious, both on the ledger, and in the real world.
- The real crux is alignment of incentives, why would you spend resources gaining control over the Bitcoin network, when that control would itself render the Bitcoin network less valuable?

Security Limits

- This IS a potential avenue of attack, and the main limitation of the core security approach.
- No conceptual reason someone couldn't take control over the network if sufficiently motivated. Especially short-term control. (Double Spend Pizza Example!)
- In practice, this means you shouldn't trust transactions until the network has spent some time establishing the correct blockchain, basically a settlement period.
- Fortunately, long-term control is out of reach of all but the largest nation-states, and they'd need to be highly motivated to disable the network.

Bitcoin Ownership/Control

- We've mentioned briefly that it's hard to pass off entirely fraudulent transactions on our ledger, time to examine that, and the last core element of Bitcoin protocol security.
- Bitcoin isn't owned, accounts termed Addresses are controlled.
- Addresses have three main elements:

  Public Address – anyone can see, the account's identifier

  Private Key – authority over a public address, creates signatures for new transactions

  Balance – how much Bitcoin is credited to the account, public, easily verifiable

- When a new transaction is proposed, cryptographic techniques are used to combine the private key and the transaction to create a unique signature.

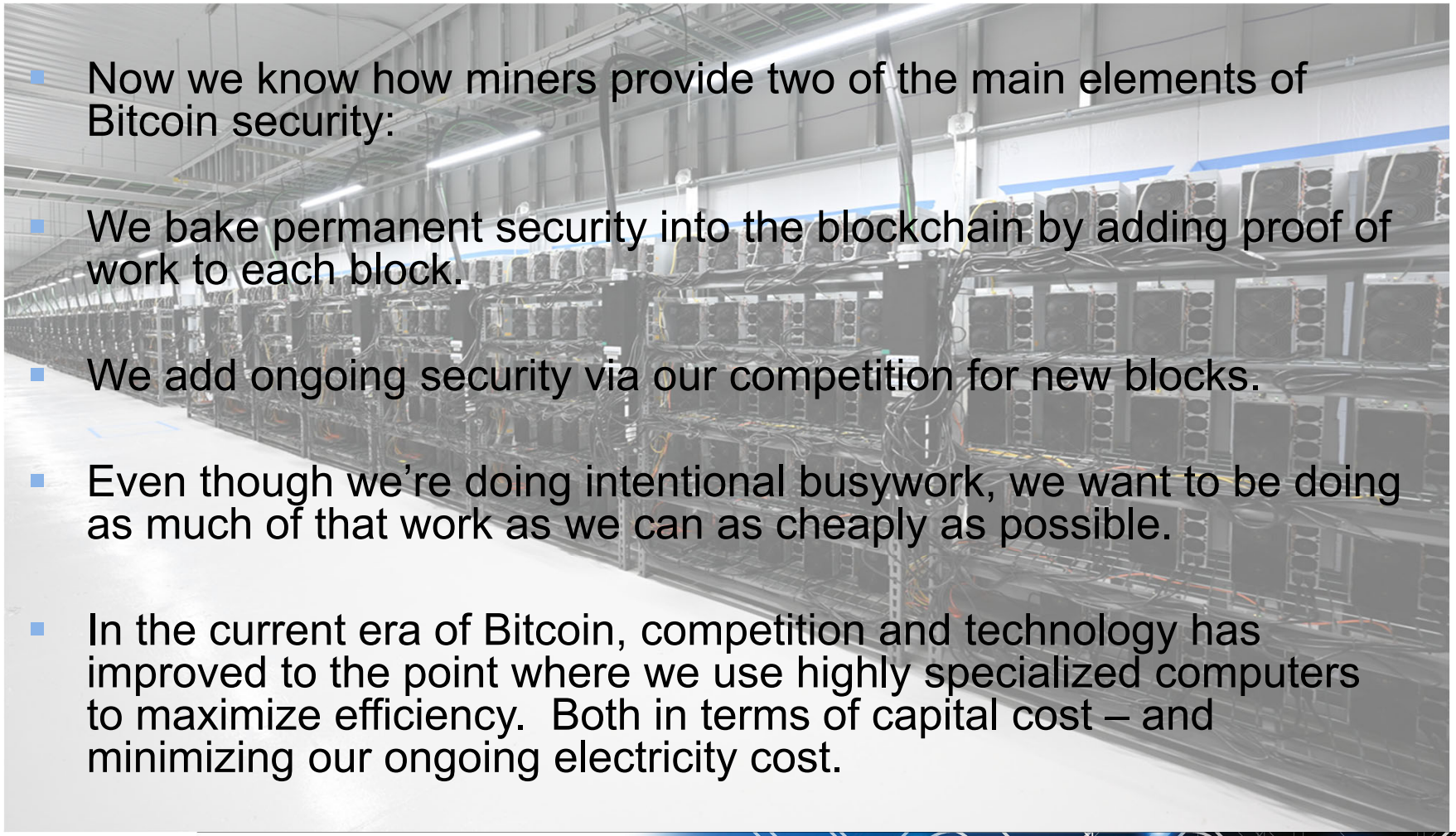
Bitcoin Ownership/Control – Pt 2

- Very easy to verify if the signature for a transaction is correct based on the transaction's contents and public address, VERY hard to determine the private key.
- Anyone can control a new, valid address by randomly "creating" a private key. Potential address space is so large that randomly generating keys will essentially never collide with existing accounts.
- Decades or centuries to find any existing address, using all the computational power on Earth.
- A least until quantum computers!

Recap

- Let's review:
- The Bitcoin network is a public, consensus-based ledger that looks for the longest valid blockchain.
- The ledger is very difficult to alter based on proof of work included in each new batch of transactions.
- Miners are incentivized via new Bitcoin issued to propose valid blocks. The network relies on competition and alignment of interests to maintain accuracy and fairness.
- It is impossible to fake a transaction without control over the private key to an account.

The Miner's Perspective



- Now we know how miners provide two of the main elements of Bitcoin security:
- We bake permanent security into the blockchain by adding proof of work to each block.
- We add ongoing security via our competition for new blocks.
- Even though we're doing intentional busywork, we want to be doing as much of that work as we can as cheaply as possible.
- In the current era of Bitcoin, competition and technology has improved to the point where we use highly specialized computers to maximize efficiency. Both in terms of capital cost – and minimizing our ongoing electricity cost.

Efficient Miners

- Electricity cost is the primary operating cost for a grid-based miner like Toshi.
- We've worked in partnership with Brakey Energy to take advantage of several energy strategies to minimize our pricing.
- Most of these programs also help minimize our impact on the electrical grid, and actually contribute positively to grid stability. A case of alignment of our economic interests with desirable real-world outcomes!





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Energy Management Strategies for Toshi

General Observations

- Toshi is a *dream* customer from an energy management perspective.
  - Significant electric consumption
  - High load factor
  - Extremely load responsive
- Every tool in the energy management playbook is available to them.
  - These tools need to be deftly used to drive down all-in costs in a volatile pricing environment for a highly price sensitive customer.

Energy Management Strategies for Toshi

1) Defaulting to the Standard Service Offer (SSO)
2) Contracting with a Certified Retail Electric Service (CRES) supplier for power
3) Contracting with a Curtailment Service Provider
    i. Emergency Demand Response
    ii. Economic Demand Response
    iii. Synchronous Reserves
4) Achieving a Unique Arrangement at the Public Utilities Commission of Ohio (PUCO)
    i. Toshi sought entry into FirstEnergy's Non-Market Based Services Pilot Program ("Transmission Pilot")
5) Capacity and transmission Coincident Peak management
6) Synchronizing all strategies
    i. Chasing <5¢

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Charges From Ohio Edison	
Customer Number: [redacted]	
Rate: General Service Transmission OE-GTF	
Customer Charge	320.00
Distribution Related Component	14,563.06
Economic Development Component	1.63
Cost Recovery Charges	21,875.42
Bypassable Generation and Transmission Related Component	145,192.88
Consumer Rate Credit	-6,765.13
Current Consumption Bill Charges	**175,187.86**
Detail Payment and Adjustment Information	
06/30/22 Payment	-118,437.94

(1) Defaulting to the SSO

Defaulting to the Utility for Generation Service

- Ohio's investor-owned Electric Distribution Utilities (EDUs) are required to provide default generation service to customers that do not contract through an alternative supplier.
  - This default service is referred to as the Standard Service Offer (SSO).

SSO Auctions

- Each EDU procures supply (*i.e.,* energy, capacity, and ancillary services) for its SSO customers through a series of Competitive Bidding Process (CBP) auctions.
- CBP auctions are held in the 2+ years leading up to each June 1 through May 31 delivery year.
- Since Summer 2021, SSO rates have been very competitive compared to retail prices for most EDUs.
  - This trend is finally reversing itself.

Current SSO Rates

	CURRENT SSO RATES in ¢/KWH				
	OE	CEI	TE	AEP	AES
Residential	5.38¢	5.47¢	5.44¢	6.74¢	10.91¢
Secondary	5.32¢	5.35¢	5.31¢	6.63¢	10.91¢
Primary	5.06¢	5.12¢	5.05¢	6.32¢	10.63¢
Subtransmission	4.87¢	4.92¢	4.82¢	N/A	10.52¢
Transmission	4.80¢	4.78¢	4.81¢	6.11¢	10.52¢

*Due to the per kWh tiered structure of the capacity portion of Duke's SSO rate, SSO rates vary for each Duke customer class.

SSO Strategy for Toshi

- Since power flow started for Toshi, it has been purchasing electric generation as an SSO customer.
- While we continue to watch the market, Toshi will begin competitively sourcing power and migrate off of the SSO as early as its March 2023 meter read and no later than its May 2023 meter read.

Recent SSO Auction Results

FirstEnergy SSO Auction Results

Auction Date	% of Supply	Auction Result (¢ / kWh)
Oct 4, 2022	33%	12.23¢
Jan 10, 2023	33%	9.77¢
Mar 20, 2023	34%	TBD
Current Weighted Average		11.00¢

AEP Ohio SSO Auction Results

Auction Date	% of Supply	Auction Result (¢ / kWh)
Nov 1, 2022	45%	12.00¢
Mar 7, 2023	55%	TBD

AES Ohio (DP&L) SSO Auction Results

Auction Date	% of Supply	Auction Result (¢ / kWh)
Nov 28, 2022	35%	11.34¢
Apr 4, 2023	25%	TBD
Apr 4, 2023	40%	TBD

Duke Ohio SSO Auction Results

Auction Date	% of Supply	Auction Result (¢ / kWh)
Sep 20, 2022	20%	11.58¢
Feb 21, 2023	50%	TBD
Feb 21, 2023	30%	TBD

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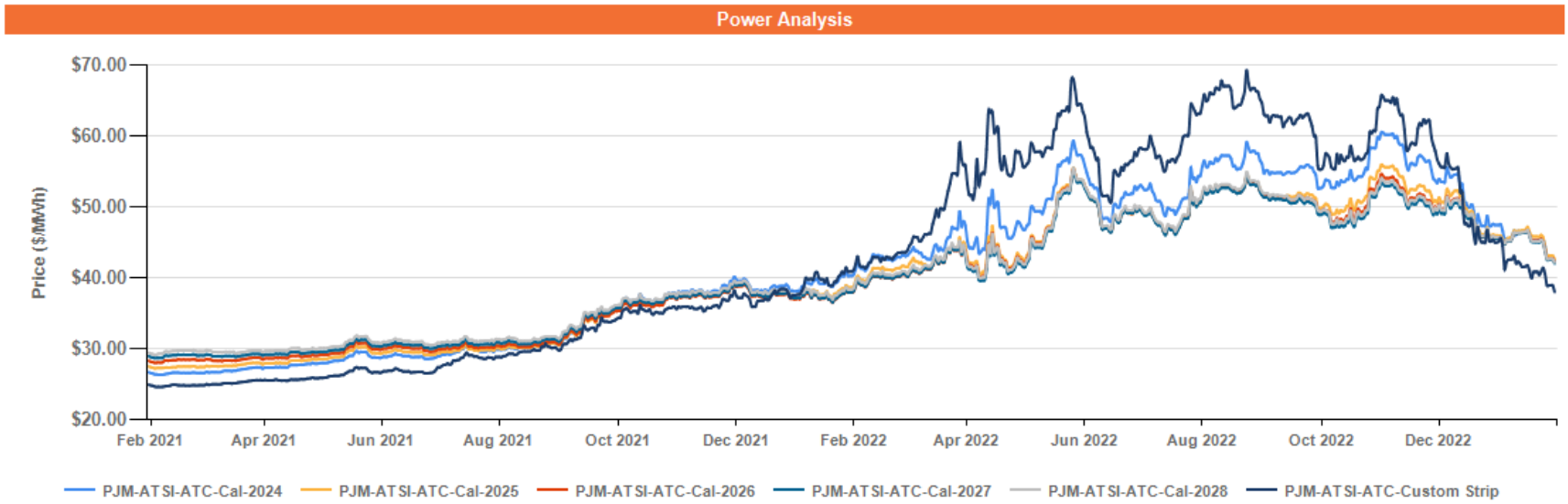
(2) Contracting with a CRES Supplier

Calendar Year Strip ATC Power Forward Prices



(Balance of 2023)

Pricing as of February 21, 2023, courtesy of Direct Energy Business.

Forward Power Prices

- Extreme relative value in Spring 2023
- Market has abruptly shifted from extreme backwardation to contango

	ATSI		
	On	Off	ATC
Mar 2023	$34.45	$30.80	$32.61
Apr 2023	$35.90	$29.15	$32.15
May 2023	$38.30	$29.40	$33.61
Jun 2023	$42.95	$29.40	$36.02
Q2 2023	$39.05	$29.32	$33.93
Q3 2023	$51.72	$34.62	$42.44
Q4 2023	$44.50	$35.53	$39.64
Q1 2024	$58.29	$50.64	$54.23
12 Month strip	$47.62	$37.08	$41.98
Balance 2023	$44.03	$32.92	$38.06
Cal 2024	$48.32	$37.09	$42.33
Cal 2025	$48.91	$37.24	$42.67
Cal 2026	$48.41	$36.67	$42.27
Cal 2027	$48.28	$36.44	$42.08
Cal 2028	$48.43	$36.59	$42.20
Cal 2029	$48.63	$36.79	$42.43

Pricing as of February 21, 2023, courtesy of Direct Energy Business.

Contracting for a Block-and-Index Product

- Pros:
  - Minimize supplier risk premium.
  - Allows for fully internalizing the benefit of curtailment and scheduling capabilities.
  - More likely for Toshi to hit its all-in price goals.
- Cons:
  - Spot prices can move quickly and aggressively.
  - Significant upside exposure.
  - Less budget certainty.
  - More time and effort goes into managing.

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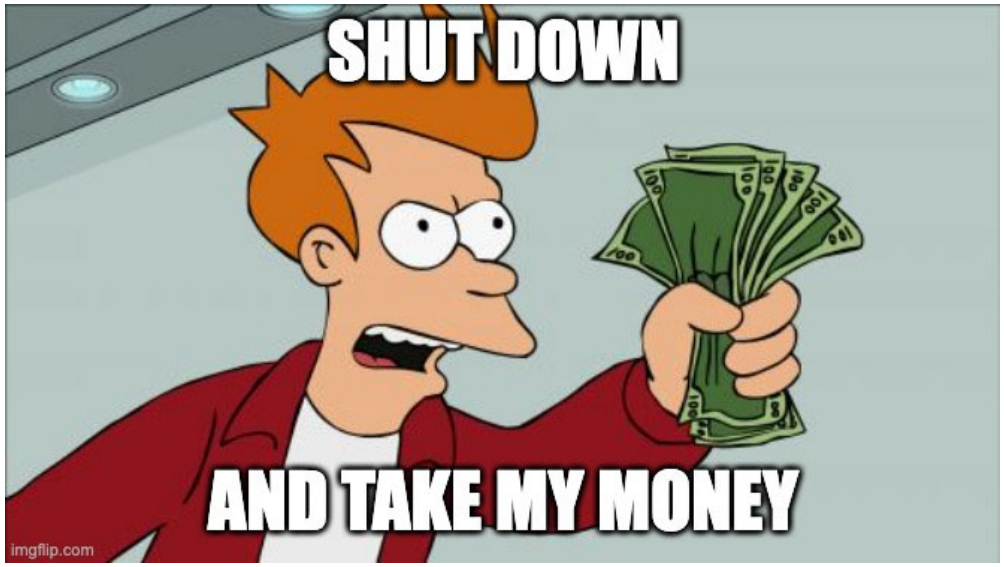

(3) Contracting with a Curtailment Service Provider

Participating in Demand Response

- Demand Response (DR) is a program offered in PJM that gives customers the opportunity to participate in the energy, capacity, and ancillary services markets by responding to grid conditions and wholesale prices.
- Participating customers may curtail their load (or shift load to a qualifying generator) in response to grid emergencies and receive payment for their performance.
- Enrollment in DR programs is conducted through Curtailment Service Providers (CSPs).

PJM Demand Response Programs

- PJM offers a number of DR programs, including:
  - Emergency DR
  - Economic DR
  - Reserves
  - Regulation

  Emergency DR, Economic DR: Energy and Capacity Markets

  Reserves, Regulation: Ancillary Services Market

- Each program has:
  - Unique qualifying criteria;
  - Program rules or guidelines; and
  - Market-based compensation.

Emergency DR

- Events can be called an unlimited number of times, any day of the year, for an unlimited duration.
  - June – October, May: 10:00 AM – 10:00 PM
  - November – April: 6:00 AM – 9:00 PM
- Dispatch notification window ranges from 30 – 120 minutes.
- In the absence of a DR event during a delivery year (DY), an annual audit or test is conducted to serve as the basis for compensation.

Emergency DR Earnings Potential

- CSP determines nomination potential by considering a customer's:
  - Peak Load Contribution (PLC) and Winter Peak Load (WPL);
  - Firm Service Levels (FSL);
  - Line Loss Factors (LLF); and
  - Winter Weather Adjustment Factor (WWAF).
- Capacity payments are awarded each DY based on audit or event performance.
- Energy payments are awarded based on PJM LMP and event performance.
- PJM payment allocation to CSP and customer is referred to as the "% split."

DY	PJM ATSI RPM ($ / MW-day)
2021/2022	$ 160.21
2022/2023	$ 50.05
2023/2024	$ 34.13

Economic DR

- Economic DR enables customers to voluntarily curtail load in response to elevated wholesale energy market prices.
- Generators are eligible if they meet the non-emergency requirements of RICE NESHAP/NSPS.
- Unlimited annual events can be called 24x7x365.
- Customer has control over establishing:
  - Price trigger;
  - Length of curtailment; and
  - Frequency of participation.
- Customers can participate in:
  - Real-time energy market with notification 2 hours before event; and
  - Day ahead energy markets with notification by 4:30 PM day prior to event.

Reserves

- Synchronized reserve enables customers to receive capacity payments for responding to short-term imbalances in supply and demand on the grid.
- Generators are eligible if they meet the non-emergency requirements of RICE NESHAP/NSPS.
- Unlimited annual events can be called 24x7x365.
- Events may not exceed 30 minutes.
- Customer has control over establishing curtailment schedule or hourly availability each week.
- Dispatch notification is 10 minutes prior to an event.
- Automated control of curtailed load is required.

Toshi Demand Response Strategy

- Toshi is emphasizing participating in reserves and economic demand response programs.
  - Toshi's highly responsive load and sensitivity to energy prices make it the perfect customer for both programs.
  - Participation in emergency is limited because of aggressive summer Coincident Peak management.

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(4) Transmission Pilot Program Unique Arrangement Application

Transmission Pilot Programs

- FE, AEP, and DP&L currently have pilot programs in place.
- These programs permit eligible customers to pay for transmission based primarily on how they use power during specific one-hour intervals of the year when demand on their respective zonal grids peak.
  - These one-hour interval peaks are referred to as “Coincident Peaks” (CPs).

Benefit of Transmission Pilot Programs

- Customers that operate off-peak or that are not weather-sensitive may have PJM-based transmission tags that are significantly lower than their monthly billed demands.
  - Monthly billed demand is the most significant factor for establishing transmission costs for non-pilot customers.
- Customers that can curtail demand in response to potential zonal grid peaks can lower their transmission tags.
- There is the potential for these types of customers to save significantly on their transmission costs.

Toshi Unique Arrangement Application

BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application for Establishment of a Unique Arrangement for Toshi CMC, LLC	)))	Case No. 21-1205-EL-AEC

APPLICATION FOR UNIQUE ARRANGEMENT

In accordance with R.C. § 4905.31 and Ohio Adm. Code § 4901:1-38-05, Toshi CMC, LLC (“Toshi” or "Customer") requests that the Public Utilities Commission of Ohio ("Commission") approve this Application for the establishment of a unique arrangement with Ohio Edison Company (“Ohio Edison”), Cleveland Electric Illuminating Company (“CEI”), and Toledo Edison Company (“Toledo Edison”) (collectively, “FirstEnergy” or “Companies”). This Application seeks to adjust how Toshi is billed for transmission service and in a manner that will not result in any delta revenue to be paid by other customers.

Toshi Unique Arrangement Approval

- Toshi's Unique Arrangement was approved by the PUCO.
- Toshi is now saving approximately 0.7¢ per kWh as a pilot customer.

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(5) Transmission and Capacity Coincident Peak Management

CP Management

- Through its Unique Arrangement, Toshi is now billed based on its transmission tag.
  - Minimizing consumption during the five hours out of the year where demand on FirstEnergy-Ohio's ATSI Zone peak will help lower Toshi's tag.
- Once Toshi begins competitively sourcing power, capacity costs will flow through to it based on how it consumed power during the five hours out of the year where demand on the PJM electric grid peaks (Capacity CPs).
  - This sets Toshi's PLC, also sometimes known as its "cap tag."

Transmission CP Alert

TRANSMISSION COINCIDENT PEAK ALERT

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An important message for clients brakeyenergy.com

This Alert is only applicable to FirstEnergy (FE) customers that both (1) qualify for — or are enrolled in — FE-Ohio's transmission pilot program, and (2) are seeking to minimize their transmission cost obligations. If you do not meet these criteria, then you may disregard this message.

Based on updated weather and load forecasts for the ATSI Zone region, we are maintaining our HIGH risk assessment that an ATSI Zone Transmission Coincident Peak (CP) will be set today, Wednesday, June 15, 2022. We estimate the chance that today will set an ATSI Zone Transmission CP come year end to be approximately 70%.

The table below summarizes Brakey Energy's current seven-day CP risk assessment for the ATSI Zone:

Table 1: Brakey Energy's Seven-Day CP Risk Assessment for ATSI Zone

Date	Current Risk Assessment	Previous Risk Assessment
Wed, 6/15/22	HIGH	High
Thu, 6/16/22	MODERATE	Moderate
Fri, 6/17/22	NO MATERIAL RISK	No Material Risk
Sat, 6/18/22	NO MATERIAL RISK	No Material Risk
Sun, 6/19/22	NO MATERIAL RISK	No Material Risk
Mon, 6/20/22	NO MATERIAL RISK	No Material Risk
Tue, 6/21/22	VERY SLIGHT	N/A

We advise FE-Ohio end users that are seeking to manage their transmission costs begin preparations to curtail or shift afternoon load. Three hours — hours-ending (HE) 3:00 PM, 4:00 PM, and 5:00 PM — are the most important to target. Conservative users should also target HE 2:00 PM and 6:00 PM if not overly disruptive to operations. Very conservative users should additionally target HE 1:00 PM and 7:00 PM. We do not believe there is a material risk that an ATSI Transmission CP will occur at any other hour today.

We urge our clients to employ as conservative a curtailment window as possible when chasing ATSI peaks. With end users representing hundreds of Megawatts (MW) subscribed to our alerts, and the financial incentive for hitting peaks increasing each year, peaks can easily be shifted from hour-to-hour because of curtailments. Please see our Game Theory section of our 2022 CP Forecasting Report for more analysis on this phenomenon.

As seen below, PJM is forecasting today's ATSI Zone load to peak at 13,117 MW at HE 5:00 PM.

Capacity CP Alert

CAPACITY COINCIDENT PEAK ALERT

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An important message for clients brakeyenergy.com

This alert is applicable to all interval-metered customers seeking to manage their capacity cost obligations. With capacity prices very low for the upcoming delivery year, we would not fault customers for being highly selective in the days they choose to curtail.

Based on updated weather and load forecasts for the entire PJM region, we are maintaining our HIGH risk assessment that a Capacity Coincident Peak (CP) will be set today, Wednesday, July 20, 2022. We estimate the chance that today will set a PJM Capacity CP come year end to be approximately 75%.

The table below summarizes Brakey Energy's current seven-day CP risk assessment for the PJM Regional Transmission Organization (RTO). PJM rules preclude a Capacity CP being set on a weekend, hence our "No Risk" risk assessment for Saturday and Sunday.

Table 1: Brakey Energy's Seven-Day CP Risk Assessment for PJM RTO

Date	Current Risk Assessment	Previous Risk Assessment
Wed, 7/20/22	**HIGH**	High
Thu, 7/21/22	**HIGH**	High
Fri, 7/22/22	**HIGH**	High
Sat, 7/23/22	**NO RISK**	No Risk
Sun, 7/24/22	**NO RISK**	No Risk
Mon, 7/25/22	**VERY SLIGHT**	Very Slight
Tue, 7/26/22	**NO MATERIAL RISK**	N/A

We advise interval-metered end users that are seeking to manage their capacity cost obligations begin preparations to curtail afternoon load. ***We believe the most important hours to target are hour-ending (HE) 5:00 PM and 6:00 PM.*** Conservative users can also target HE 3:00 PM and 4:00 PM. Very conservative users can additionally target HE 2:00 PM. We do not believe that there is a material risk that a Capacity CP will be set at any other hour today.

As seen below, PJM is forecasting today's system-wide load to peak at 149,522 megawatts (MW) at HE 5:00 PM.

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(6) Synchronizing Strategies: Chasing <5¢

Chasing <5¢

- How we have successfully positioned Toshi to pay less than 5¢ per kWh all-in:
  1. Camped out on the SSO during the worst of recent market turmoil;
  2. Contracting for a block-and-index product that minimizes supplier premium while allowing Toshi to internalize benefit of curtailment capabilities;
  3. Taking advantage of various demand response programs, including lesser-utilized economic and reserves;
  4. Being active in the regulatory process; and
  5. Actively CP managing for capacity and transmission.

Biographical Information

Matthew Brakey, President, Brakey Energy
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Matt Brakey is an Ohio energy professional who directs all services Brakey Energy provides to clients and leads the company's operations. He is an expert on Ohio energy rates and markets, securing and negotiating third-party commercial and industrial energy contracts, and navigating Ohio's energy regulatory environment. Matt joined Brakey Energy in 2004 and become President in 2010.

In addition to his client responsibilities, Matt has been retained as an expert witness in high-profile energy litigation. One such case, Schwebel Baking Company, et al. v. FirstEnergy Solutions Corp, reached a $12 million settlement. This class action lawsuit resulted from surcharges assessed to commercial and industrial customer electric bills relating to the 2014 polar vortex. Matt was the sole subject matter expert for plaintiffs.

Under Matt's leadership, Brakey Energy was honored with the prestigious Weatherhead 100 Upstart award in 2015, 2017, and 2019, which is given to companies that achieve outsized five-year growth. In addition, Matt is a past Crain's Cleveland Business Forty under 40 award winner for his professional success and civic contributions.

Matt served two terms as Chairman of the Ohio Energy Leadership Council (OELC), where he helped the organization in its pursuit of reliable energy at reasonable prices for Ohio businesses. He is currently the Secretary Treasurer of the organization. Brakey Energy is also retained by OELC for its energy expertise.

Matt is a frequent speaker, seminar presenter, and published author on Ohio energy issues. He has been featured and cited in many publications, including the New York Times, Forbes, the Cleveland Plain Dealer, the Columbus Dispatch, Crain's Cleveland Business, the Dayton Daily Journal, and the National Journal.

Matt holds a J.D. from the Cleveland-Marshall College of Law, where he graduated cum laude, and a B.A. from Miami University.

Matt lives in Russell Township, Ohio with Carolyn, his wife, and their seven-year-old twins. In his spare time, Matt enjoys being involved with his church, running road races with his son, and coaching the Unicorn Sprinkles, his daughter's basketball team.

David Zadeh, COO, Toshi CMC, Norwalk, OH
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David Zadeh has been Chief of Operations for Toshi CMC since 2020. David has spearheaded development of Toshi's 75 Ontario site for cryptocurrency mining. Prior to Toshi, David served as Head of Research at Norwood Capital, focusing on equity research in the Technology and Biopharmaceuticals sectors. David is a University of Pittsburgh alumnus, where he studied Accounting and Finance.